Threats are also known as "sources of stress" and are the "proximate activities or processes that have caused, are causing or may cause the stress (*e.g.*, the direct or indirect impairment of salmonid habitat from human or natural sources)" (TNC 2007). The NCCC Domain refined The Nature Conservancy Conservation Assessment Planning (CAP) threats taxonomy to include both human activities and natural events as "sources of stress."

1. Agricultural Practices – Annual and perennial non-timber crop farming and associated operations (does not include grazing, ranching or timber harvest operations).

Actions include but are not limited to:

The practice and all associated operations of developing, maintaining, continuous or seasonal ground disturbance, planting, harvesting, fertilizing, and irrigating row crops, orchards, vineyards, commercial greenhouses, nurseries, gardens, *etc*.

Stresses to be considered:

1. Water-borne pollutants such as sediment, pesticides, and elevated nutrient levels,
2. Alteration in riparian vegetation integrity, diversity, function, and composition,
3. Alteration of natural drainage channels and hydrology,
4. Channel simplification and alteration in streambank stability, and
5. Cumulative, chronic and instantaneous water diversion and water withdrawal methods.

A High threat ranking results when ecosystem function and process are (or are expected to be) severely altered and/or requires a substantial commitment of resources to ameliorate the threat. A high threat could include practices requiring large quantities of water for irrigation and large quantities of pesticides and herbicides over significant proportions of the watershed.

A Moderate threat ranking results when ecosystem function and process are (or are expected to be) moderately altered but with a reasonable commitment of resources could be reversed or ameliorated.

A Low threat ranking results when ecosystem function and process are (or are expected to be) largely intact, slightly altered, and easily reversible. A low threat could include practices that include non-irrigated crops and low use of herbicides and pesticides over significant proportions of the watershed.

2. Channel Modification - Actions directly or indirectly modifying and/or degrading channel-forming processes and morphology of perennial, intermittent and ephemeral streams and estuarine habitats.

Actions include but are not limited to:

Estuarine management (lagoon breeching, dredging), flood control, maintenance activities, large woody debris removal, levee construction, vegetation removal, herbicide application, stream channelization, bank stabilization (hardening that limits channel movement), dredging and other forms of sediment removal. These actions typically occur within the two-year bankfull channel and adversely affect channel forming processes.

Stresses to be considered:

1. Loss of instream and near stream habitat and habitat complexity,
2. Vegetation loss resulting in decreased channel roughness (decrease in Manning's N roughness coefficient),
3. Alteration of drainage channels and hydrology,
4. Alteration in riparian zone diversity, function, and composition,
5. Alteration in channel and streambank stability,
6. Alterations/loss of floodplain/estuarine/wetland habitats,
7. Water-borne pollutants such as sediment, chemicals, and adverse changes in nutrient levels,
8. Channel simplification, incision and floodplain disconnection.

A High threat ranking results when ecosystem function and process are (or are expected to be) severely altered and/or requires a substantial commitment of resources to ameliorate the threat. A high threat could include large levee projects within IP-km that adversely modify sediment transport, accelerated stream velocities and riparian vegetation from historical conditions.

A Moderate threat ranking results when ecosystem function and process are (or are expected to be) moderately altered but with a reasonable commitment of resources could be reversed or ameliorated.

A Low threat ranking results when ecosystem function and process are (or are expected to be) largely intact, slightly altered, and easily reversible. A lower threat could include bank stabilization projects that use bioengineering techniques.

3. Climate Change - Long-term climatic changes which may be linked to global warming and other severe climatic/weather events outside the range of natural variation. This threat results in habitat shifting and alteration resulting in major changes in habitat composition and location (sea-level rise, desertification).

Actions include but are not limited to:

Managing water storage to provide cool water refugia,
Additional demands on existing water supplies.

Stresses to be considered:

1. Changes in water temperatures and natural hydrograph compared to salmonid migration patterns,
2. Changes in vegetative communities that will adversely alter riparian process and function.

A High threat ranking results when ecosystem function and process are (or are expected to be) severely altered and/or requires a substantial commitment of resources to ameliorate the threat. A high threat may include circumstances that preclude future opportunities to protect critical refugia habitats.

A Moderate threat ranking results when ecosystem function and process are(or are expected to be) moderately altered but with a reasonable commitment of resources could be reversed or ameliorated.

A Low threat ranking results when ecosystem function and process are (or are expected to be) largely intact, slightly altered, and easily reversible.

4. **Fire & Fuel Management** – Fires (including wildfires and prescriptive burns) and fire suppression (fire fighting and fire prevention) actions.

Actions include but are not limited to:

Construction of fire breaks, roads, application of fire retardants, water use planning, fuels management, fire suppression.

Stresses to be considered:

1. Increased erosion, sedimentation and landslide potential,
2. Elevated fuel loading leading to catastrophic burns,
3. Loss of future large woody debris recruitment,
4. Alterations of vegetative/riparian communities from invasive species/post-fire management

A High threat ranking results when ecosystem function and process are (or are expected to be) severely altered and/or requires a substantial commitment of resources to ameliorate the threat. A high threat may include high fuel loading over a large area of extensive burns above or adjacent to critical spawning and rearing areas.

A Moderate threat ranking results when ecosystem function and process are (or are expected to be) moderately altered but with a reasonable commitment of resources could be reversed or ameliorated.

A Low threat ranking results when ecosystem function and process are (or are expected to be) largely intact, slightly altered, and easily reversible. A mature redwood forest upstream and adjacent to IP-km generally will rank as a low threat due to the fire resistant qualities of redwood.

5. Fishing and Collecting - Harvesting salmonids for recreation, subsistence, in-*situ* research, or cultural purposes; includes illegal and legal activities including accidental mortality/bycatch

Actions include but are not limited to:

Legal harvest for recreation and subsistence, authorized relocation, research and collection, incidental capture (*e.g.*, hooking), and illegal activities such as poaching and unpermitted collection

Stresses to be considered:

1. Mortality/harm and displacement,
2. Increased competition when fish are relocated,
3. Depensatory effects.

A High threat ranking results when impacts to the population are (or are expected to be) severe and will requires a substantial commitment of resources to ameliorate the threat. A high threat may occur in critical adult staging areas with extensive legal and illegal fishing pressure.

A Moderate threat ranking results when impacts to the population are (or are expected to be) moderate but with a reasonable commitment of resources the impact could be reversed or ameliorated.

A Low threat ranking results when impacts to the population are (or are expected to be) low and easily reversible. A low threat may occur in watersheds under large private (*i.e*., commercial timberlands) ownership where public access is restricted or in areas with significant enforcement presence.

6. Hatcheries & Aquaculture – Hatchery and fish farming practices

Actions include but are not limited to:

Fish capture, rearing, and release methods,

Stresses to be considered:

1. Genetic (in- and outbreeding depression),
2. Escapement of salmonids from fish farms and intraspecific consequences (*e.g*., competition for redds) to wild salmonids,
3. Parasites and diseases (*e.g*., Bacterial Kidney Disease),
4. Intraspecific consequences of escapes from fish farms (*e.g.*, competition for redd sites) to wild salmonids,
5. Pollution and elevated nutrients associated with facilities,
6. Introduction of out-of-ESU/DPS salmonids,
7. Capture of wild spawners used supplement hatchery program and thus reducing total run size,
8. Impediments to migration resulting from fish capture and rearing facilities,

A High threat ranking results when impacts to the population are (or are expected to be) severe and will requires a substantial commitment of resources to ameliorate the threat

A Moderate threat ranking results when impacts to the population are (or are expected to be) moderate but with a reasonable commitment of resources the impact could be reversed or ameliorated.

A Low threat ranking results when impacts to the population are (or are expected to be) low and easily reversible.

7. Storms and Flooding – Above average rainfall and stream flow events. Natural events that exacerbate already degraded conditions.

Stresses to be considered:

1. Increases in frequency, duration, and magnitude of flooding beyond natural conditions
2. Flood fighting actions
3. Loss of riparian and instream habitat attributes
4. Increased frequency of channel scour beyond natural conditions
5. Increased turbidity beyond natural conditions

A High threat ranking results when (1) ecosystem function and process are (or are expected to be) severely altered or (2) impacts to the population are severe. A High threat occurs when amelioration of the consequences of this threat is largely irreversible and/or requires a substantial commitment of resources. A high threat ranking may occur in heavily urbanized watersheds subjected to extensive and ongoing instream modification conducted for flood control purposes.

A Moderate threat ranking results when (1) ecosystem function and process are (or are expected to be) moderately altered or (2) impacts to the population are moderate. A Moderate threat occurs when the consequences of this threat are largely irreversible but with a reasonable commitment of resources and planning the impacts could be ameliorated.

A Low threat ranking results when (1) ecosystem function and processes remain largely intact or are (2) slightly altered, and easily reversible. A low threat ranking may occur in watersheds with little urban interface, intact floodplains, and instream habitat forming features (such as LWD) are present and are not routinely removed.

8. Droughts – Less than the seasonal average (mean) of rainfall during a calendar "water year" with attendant effects to streamflow and riparian condition.

Stresses to be considered:

1. Insufficient flows to facilitate egg incubation, juvenile rearing, smolt outmigration, and juvenile upmigration,
2. Poor water quality leading to increased instream temperatures, low DO, decreased food availability, increased concentrations of pollutants, *etc*.,
3. Earlier than normal water diversion for anthropogenic purposes,
4. Insufficient flows to breach sandbars at river mouths.

A High threat ranking results when ecosystem function and process are (or are expected to be) severely altered and/or requires a substantial commitment of resources to ameliorate the threat. A high threat ranking may occur in watersheds where water is already over allotted under normal flow conditions.

A Moderate threat ranking results when ecosystem function and process are (or are expected to be) moderately altered but with a reasonable commitment of resources could be reversed or ameliorated.

A Low threat ranking results when ecosystem function and process are (or are expected to be) largely intact, slightly altered, and easily reversible.

9. Disease, Predation and Competition - Native and non-native and species, (sealions, mergansers, *Arundo donax, etc*.), having or predicted to have significant harmful effects on salmonids and/or their habitat.

Actions include but are not limited to:

Introduction of non-native animal species that prey upon and/or (directly or indirectly) compete with native salmonids, introduction of non-native vegetation that competes with and/or replaces native vegetation, creation of conditions favorable to increased populations and/or concentration of native predators.

Stresses to be considered:

1. Habitat simplification,
2. Reduced feeding opportunities,
3. Shifts in native/non-native biotic communities and salmonid abundance resulting in disproportional predation and competition,
4. Changes in water chemistry (*e.g*. Eucalyptus, low DO resulting from increased foreign biomass),
5. Impediments to instream movement and migration (*Arundo donax*)

A High threat ranking results when (1) ecosystem function and process are (or are expected to be) severely altered or (2) impacts to the population are severe. A High threat occurs when amelioration of the consequences of this threat is largely irreversible and/or requires a substantial commitment of resources.

A Moderate threat ranking results when (1) ecosystem function and process are (or are expected to be) moderately altered or (2) impacts to the population are moderate. A Moderate threat occurs when the consequences of this threat are largely irreversible but with a reasonable commitment of resources and planning the impacts could be ameliorated.

A Low threat ranking could result when (1) ecosystem function and process remain largely intact or (2) are slightly altered, and easily reversible.

10. Livestock farming & ranching - Domestic terrestrial animals raised in one location or domestic or semi-domesticated animals allowed to roam in the wild and supported by natural habitats (*e.g*., cattle feed lots, chicken farms, dairy farms, cattle ranching).

Stresses to be considered:

1. Water-borne pollutants such as sediment, toxic chemicals/substances (i.e. hormones), and elevated nutrient levels,
2. Alteration in riparian zone diversity, function, and composition,
3. Alteration of drainage channels and hydrology (soil compaction),
4. Channel simplification and alteration in streambank stability,

5. Water diversion and withdrawal.

A High threat ranking results when ecosystem function and process are (or are expected to be) severely altered and/or requires a substantial commitment of resources to ameliorate the threat

A Moderate threat ranking results when ecosystem function and process are (or are expected to be) moderately altered but with a reasonable commitment of resources could be reversed or ameliorated.

A Low threat ranking results when ecosystem function and process are largely intact, (or are expected to be) slightly altered, and easily reversible.

11. Logging & wood harvesting - Harvesting trees and ancillary post-harvest effects of these activities including changes to hydrograph, increased contribution of water-borne pollutants such as sediment and elevated nutrient levels. Additionally, this threat includes conversion of timberland (to vineyards or other uses) as first course of action in conversion process as approved by CDF.

Actions include but are not limited to:

Includes all operations associated with timber removal within the harvest unit, including skid trails, new road construction, opening of old road systems, construction of landings and yarding corridors (does not include mainline transportation systems). Maintenance of road network and erosion control devices following completion of harvest activities.

Stresses to be considered:

1. Water-borne pollutants such as sediment, toxic chemicals, and elevated nutrient levels,
2. Alteration in riparian zone integrity, diversity, function (*i.e.*, LWD recruitment), and composition,
3. Alteration of drainage channels and hydrology,
4. Channel simplification and alteration in streambank stability,
5. Water diversion and withdrawal,
6. Compromised hillslope stability.

A High threat ranking results when (1) ecosystem function and process are (or are expected to be) severely altered or (2) impacts to the population are severe. A High threat occurs when amelioration of the consequences of this threat is largely irreversible and/or requires a substantial commitment of resources. Includes activities that result in a permanent change to the landscape (*e.g.*, conversion to agriculture, urban, or other uses or results in long-lived changes to vegetative communities).

A Moderate threat ranking results when (1) ecosystem function and process are (or are expected to be) moderately altered or (2) impacts to the population are moderate. A Moderate threat occurs when the consequences of this threat are largely irreversible but with a reasonable commitment of resources and planning the impacts could be ameliorated. Includes harvest activities meeting minimum requirements of California Forest Practice Rules (CFPRs).

A Low threat ranking results when (1) ecosystem function and process remain largely intact or (2) are slightly altered, and easily reversible. Includes activities such as timber harvest that conforms to (or has higher standards beyond) CFPR (*e.g*., Pacific Forest Trust certified).

12. Mining – All types of mining and quarrying (*e.g*, instream gravel mining).

Actions include but are not limited to:

Exploring for, developing, processing, storing, and producing minerals and rocks.

Stresses to be considered:

1. Reduction in quantity and quality of stream gravel,
2. Reduced channel complexity,
3. Upstream channel changes (*e.g*., headcuts),
4. Alteration in riparian zone integrity, diversity, function, and composition,
5. Alteration of channel geometry and hydrology,
6. Alteration in streambank stability,
7. Water diversion and withdrawal,
8. Channel simplification, incision and disconnection from its floodplain,
9. Alterations/loss of floodplain/estuarine habitats,
10. Alterations in water quality from increased sedimentation, turbidity, elevated water temperatures, and inputs of toxic metals.

A High threat ranking results when ecosystem function and process are (or are expected to be) severely altered and/or requires a substantial commitment of resources to ameliorate the threat. Activities that rank as a High threat may include instream gravel mining and mining activities within the 20-year bankfull channel.

A Moderate threat ranking results when ecosystem function and process are (or are expected to be) moderately altered but with a reasonable commitment of resources could be reversed or ameliorated. Activities ranking as a moderate threat may include activities outside of the 20-year bankfull channel.

A Low threat ranking results when ecosystem function and process are largely intact, (or are expected to be) slightly altered, and easily reversible. Activities that rank as a low threat generally occur outside of the 100-year floodplain.

13. Recreational Areas and Associated Activities - Recreational activities (legal and illegal) altering, destroying and/or disturbing habitats and species outside of established transport corridors, usually for recreational reasons.

Actions include but are not limited to:

Use of off-road vehicles, motorboats, motorcycles, mountain bikes, trail maintenance, equestrian uses, and golf courses.

Stresses to be considered:

1. Excessive erosion and sedimentation,
2. Fords and effects of ORV driving in the streams,
3. Introduction of pollutants, garbage, toxic chemicals, and changes in nutrient levels,
4. Alteration in riparian zone integrity, diversity, function, and composition,
5. Alteration in streambank stability,
6. Channel simplification, incision and disconnection from its floodplain.

A High threat ranking results when ecosystem function and process are (or are expected to be) severely altered and/or requires a substantial commitment of resources to ameliorate the threat. A high threat ranking may include heavy ORV use in riparian channels that results in the destruction or modification of stream banks and riparian vegetation.

A Moderate threat ranking results when ecosystem function and process are (or are expected to be) moderately altered but with a reasonable commitment of resources could be reversed or ameliorated.

A Low threat ranking results when ecosystem function and process are largely intact, (or are expected to be) slightly altered, and easily reversible. A low threat ranking may include low impact activities such as hiking on designated and properly located and maintain trails.

14. Residential & commercial development – Urban, industrial, suburban, recreational, or rural residential developments resulting in permanent alteration of the natural environment and encroachment on floodplains and riparian areas. Development includes military bases, factories, shopping centers, resorts, *etc*. This includes ancillary consequences of development (physical and social (*i.e*., homeless encampments)) such as household sewage, urban wastewater, increased sedimentation, industrial effluents, and garbage and solid waste.

Stresses to be considered:

1. Introduction of pollutants, garbage (e.g., tires), urban/industrial wastewater, sedimentation, toxic chemicals, and changes in nutrient levels ("shock pollution" aka first flush),
2. Alteration in riparian zone integrity, diversity, function, and composition,
3. Alteration in streambank stability,
4. Channel simplification, incision and disconnection from its floodplain,
5. Alteration of drainage channels and hydrology,
6. Increased stormwater runoff,
7. Water diversion and withdrawal,
8. Growth-inducing consequences.

A High threat ranking results when (1) ecosystem function and process are (or are expected to be) severely altered or (2) impacts to the population are severe. A High threat occurs when amelioration of the consequences of this threat is largely irreversible and/or requires a substantial commitment of resources. A high threat ranking may occur in watersheds with extensive urban development adjacent to IP-km resulting in extensive modification of riparian zones from historical conditions.

A Moderate threat ranking results when (1) ecosystem function and process are (or are expected to be) moderately altered or (2) impacts to the population are moderate. A Moderate threat occurs when the consequences of this threat are largely irreversible but with a reasonable commitment of resources and planning the impacts could be ameliorated.

A Low threat ranking results when (1) ecosystem function and process remain largely intact or (2) are slightly altered, and easily reversible.

15. **Roads & railroads** – Roadways (highways, secondary roads, primitive roads, logging roads, bridges & causeways) and dedicated tracks. Includes all roads (including mainline logging roads) not associated with the site-specific footprint of timber harvest activities.

Stresses to be considered:

1. Chronic and acute introduction of sediment from surface erosion and drainage,
2. Passage impairment or blockage due to culverts, bridges, etc.,
3. Risks of spills,
4. Alteration of drainage channels, hydrology, infiltration and runoff,
5. Alteration in riparian zone diversity, function, and composition,
6. Channel simplification, incision and disconnection from its floodplain,
7. Alteration in channel and streambank stability,
8. Alterations/loss of floodplain/estuarine habitats,
9. Water-borne pollutants such as sediment, chemicals, and adverse changes in nutrient levels,
10. Growth-inducing consequences.

A High threat ranking results when (1) ecosystem function and process are (or are expected to be) severely altered or (2) impacts to the population are severe. A High threat occurs when amelioration of the consequences of this threat is largely irreversible and/or requires a substantial commitment of resources. A high threat may occur in watersheds with high road densities, poor road maintenance practices, numerous stream crossings, and placement of roads on unstable areas and adjacency to stream zones.

A Moderate threat ranking results when (1) ecosystem function and process are (or are expected to be) moderately altered or (2) impacts to the population are moderate. A Moderate threat occurs when the consequences of this threat are largely irreversible but with a reasonable commitment of resources and planning the impacts could be ameliorated.

A Low threat ranking results when (1) ecosystem function and process remain largely intact or (2) are slightly altered, and easily reversible.

16. Water diversion and impoundment – Appropriative and riparian surface water diversions and, groundwater pumping resulting in changes to water flow patterns outside the natural range of variation. This threat includes use, construction, and maintenance of seasonal dams for water diversions.

Stresses to be considered:

1. Chronic and acute introduction of sediment from surface erosion and drainage,
2. Passage impairment or blockage,
3. Alteration of drainage channels and hydrology,
4. Alteration in riparian zone diversity, function, and composition,
5. Alteration in channel and streambank stability,
6. Alterations/loss of floodplain/estuarine habitats due to reduced freshwater inflow,
7. Water-borne pollutants such as sediment, chemicals, and adverse changes in nutrient levels,
8. Growth-inducing consequences,
9. Changes in water flow and temperature,
10. Loss of gravel recruitment to downstream areas,
11. Dewatering and flow reductions,
12. Secondary effects to salmonids (*e.g.*, Bacterial Gill disease),
13. Delay in sandbar breaching (*e.g*., Scott Creek).

A High threat ranking results when (1) ecosystem function and process are (or are expected to be) severely altered or (2) impacts to the population are severe. A High threat occurs when amelioration of the consequences of this threat is largely irreversible and/or requires a substantial commitment of resources.

A Moderate threat ranking results when (1) ecosystem function and process are (or are expected to be) moderately altered or (2) impacts to the population are moderate. A Moderate threat occurs when the consequences of this threat are largely irreversible but with a reasonable commitment of resources and planning the impacts could be ameliorated.

A Low threat ranking results when (1) ecosystem function and process remain largely intact or (2) are slightly altered, and easily reversible.